ICE HOUSES

L. C. CORBETT
Horticulturist

FARMERS' BULLETIN 475
UNITED STATES DEPARTMENT OF AGRICULTURE

Contribution from the Bureau of Plant Industry
WM. A. TAYLOR, Chief

Washington, D. C. Issued December 13, 1911; revised, February, 1918

Show this bulletin to a neighbor. Additional copies may be obtained free from the Division of Publications, United States Department of Agriculture

WASHINGTON : GOVERNMENT PRINTING OFFICE : 1918

OTHER features being satisfactory, a farm is well located that has a stream or lake or pond from which a supply of good, clear, clean ice may be harvested, and the farmer is doubly fortunate if there is an ice house at hand ready to receive it.

Aforetimes, the harvesting of natural ice was the only way to provide a supply for the needs of the coming summer, and even now that the production of artificial ice is a widespread industry there are many farms and towns remote from an ice factory which can be supplied cheaply only by storing natural ice.

These war times make heavy demands upon the fuel supply of the country, and, paradoxical as it may seem, it takes fuel to produce artificial ice, while natural ice may be harvested at a time when farm work is not pressing and both man and horse labor are not otherwise profitably employed. To save natural ice until needed in periods of high temperatures requires a storage place—in other words, an ice house—hence this bulletin contains instruction as to the building of proper structures, as well as methods of harvesting the ice.

B. P. I.—697.

ICE HOUSES.

CONTENTS.

ECONOMIC IMPORTANCE.

THE great variety of uses to which ice is now put in the economies of living is sufficient reason for a brief discussion of the principles of ice preservation and the construction of ice houses. In many parts of the country the harvesting of ice is an important industry. Immense houses are constructed and equipped with elaborate power devices for elevating ice. These houses are only temporary storage quarters, however, as this great harvest of millions of tons is made to meet the wants of the sweltering cities during the heated months.

As the demand for ice in the cities increases with the rise in temperature, cars and ships are pressed into service to transport the contents of these great storehouses. Before the manufacture of artificial ice was a commercial possibility the storage and distribution of natural ice was the only means of relief for the denizens of the city from the summer heat. While at the present time most inland towns of the South rely upon the home manufacture of ice, coast cities still receive a part of their annual supply from the natural ice fields of the North, where it has been stored during the winter season.

An ample supply of ice is of greater economic importance in the country home than in the city residence. City people can purchase perishable supplies as needed, but the remoteness of country homes from markets often renders it necessary to use canned, corned, or smoked meat products during the season of the year when the table should be supplied with fresh meats. Not only is ice appreciated because of its use in the preservation of fresh meats, butter, and other table supplies, but the production of high-grade domestic dairy products is almost impossible without it. Many markets to which

milk is now shipped demand that it be cooled before shipment to a degree not attainable without the use of ice.

Ice is one of those luxuries which in many sections of the country can be had for the gathering. The cost of harvesting and storing it is not great as compared with the comfort that it brings.

THE SOURCE OF THE ICE SUPPLY.

The source of the ice supply will vary with local conditions. In many sections lakes, rivers, or large streams will afford a supply of suitable ice without special plan or preparation on the part of man. In other instances, where such natural sources are not easily accessible, small streams or even the water from a spring can be stored in an excavation or by means of a dam, so as to afford sufficient water surface to provide the desired ice supply. The harvest area or surface will depend upon the tonnage to be stored and the normal thickness of the ice in the locality. In central New York the normal ice supply ranges from 8 to 12 inches in thickness, while in eastern Virginia 4 to 6 inches is as great a thickness as can usually be counted upon.

The stream or pond from which the supply of ice is taken should be fed from a source free from contamination or pollution. If the stream is so sluggish that water weeds thrive in it, all vegetation must be removed to prevent its freezing in the ice. Decaying vegetable matter frozen in ice is very objectionable, because as the ice melts this matter is deposited in the ice box or refrigerator, rendering it unnecessarily filthy and dangerous to health.

Ponds in which green spawn or algæ grow profusely can be rid of these pests by the use of copper sulphate. The crystals can be placed in a cloth sack, which is hung to a pole and trailed through the water until the salts are dissolved. One or two treatments of the sulphate during the season at the rate of 1 pound to 100,000 gallons of water will be sufficient to keep down such growth and make the water clear and pure. It is impossible to have pure ice unless the pond or stream is clean and the water is free from contamination.

THE PRINCIPLES OF ICE STORAGE.

In order to keep so perishable a commodity as ice it is necessary in the construction of a storage structure to consider carefully those physical and mechanical principles which underlie its preservation. (1) To keep well, ice must have a minimum of surface exposed to the air or to the packing material. This is most easily accomplished by piling the ice in the form of a cube. A mass of ice 12 by 12 by 12 feet exposes less surface than the same tonnage piled in any form less nearly that of a cube or of a globe. (2) The keeping

of good ice depends upon the completeness of its insulation, whereby it is protected from external influences, such as heat and air. (3) Drainage is important because the lack of it interferes with the insulation. (4) The ice itself must be packed so as to prevent as completely as possible the circulation of air through the mass. The more nearly the mass of ice approaches that of a solid cube, both in shape and texture, the easier, with good drainage and insulation, will be the keeping problem. The keeping of ice, then, depends upon the shape of the mass, its insulation, its drainage, and its solidity.

THE ICE HARVEST.

The ease and rapidity with which ice can be gathered depend upon the condition and location of the field and the character of the tools and conveniences at hand for doing the work.

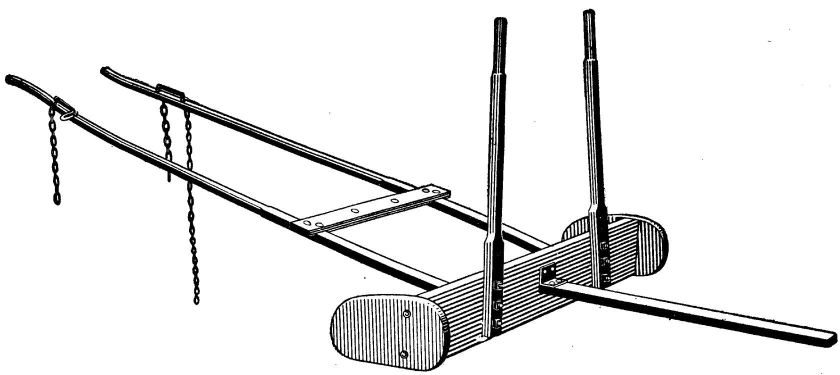

FIG. 1.—A horse-power scraper for removing snow from an ice field.

CLEARING THE ICE FIELD.

If the ice field is covered with snow the formation of ice will be retarded, as the snow acts as a blanket and raises the temperature, thus retarding the ice formation. If the ice sheet is sufficiently thick and snow falls upon it, the snow must be removed before harvesting can proceed; or if, on the other hand, it is desirable to increase the thickness of the ice after the snow falls, the field may be flooded and the snow saturated with water, which is allowed to freeze, thus adding a layer of snow ice. Flooding on small fields may be accomplished in either of two ways: (1) By "overflowing," which consists merely in conducting water to the field, or by piercing the ice field here and there with a bar or auger, to allow the water to force itself to the surface and gradually to saturate the snow.

Snow may be removed from small fields, when necessary, by means of shovels, but upon large fields it will be economical to use horse-power scrapers. A simple plank scraper is shown in figure 1.

HARVESTING THIN AND THICK ICE.

Ice not over 4 inches thick and ice from 6 to 15 inches in thickness require very different methods of procedure. The thin ice in general will be broken into more or less regular cakes, which will be loaded

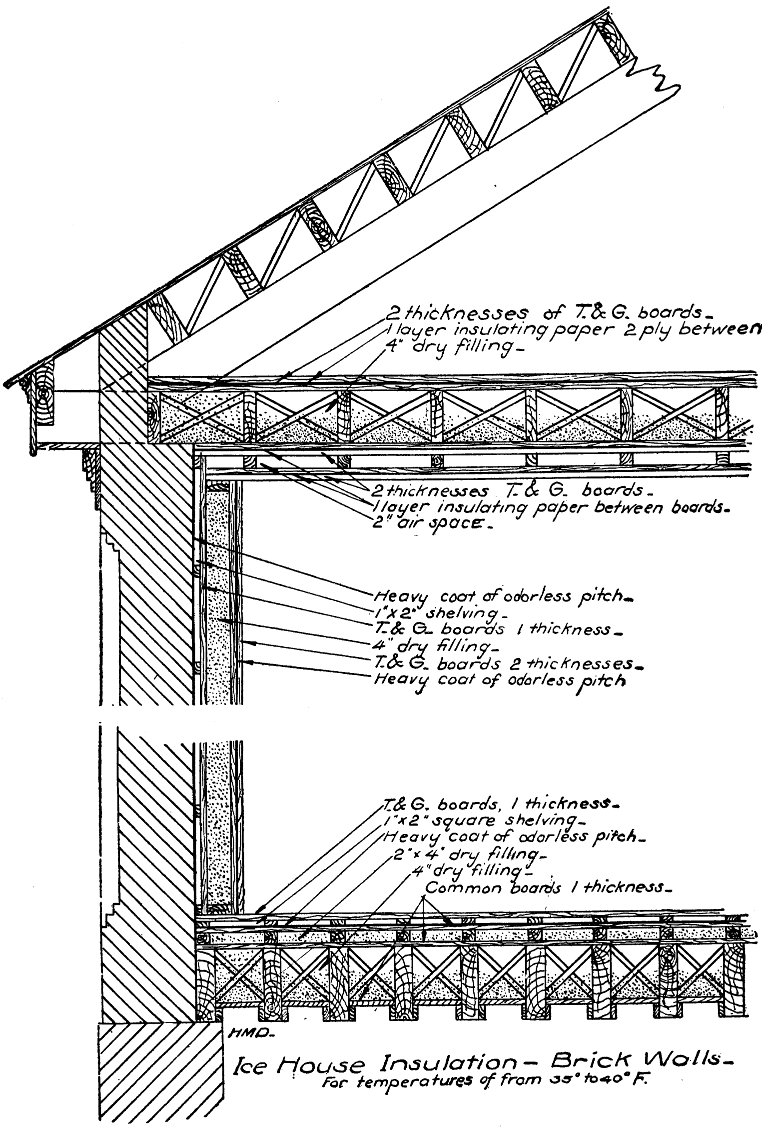

FIG. 2.—Diagram showing the insulation of an ice house for storing ice without sawdust or shavings.

as best they may into sleds or wagons and hauled to the storehouse, where they may be arranged in layers and adjusted as closely as possible, the spaces between the cakes being filled with crushed ice or snow in such a manner as to cause the whole mass to freeze into

as nearly a solid block of ice as possible. It is more difficult to store and keep ice of this character than that harvested in regular cakes. Several factors combine to make the construction of a house for the preservation of such a supply more exacting than if built for keeping a better grade. Thin ice is characteristic of the southern limits of the storage of natural ice. The supply is more or less uncertain. The storage period is long. The irregular form of the cakes makes it difficult to pack the ice so as to prevent air spaces, which may form air passages and cause rapid loss. Irregular blocks and cakes are less easily insulated than regular cakes of uniform size and thickness. If the mass is stored in a building without packing material about it, insulation must be provided for in the construction of the house. The walls must be thick, well packed with mill shavings or dry sawdust, and tightly boarded on both sides of the packing material. A space of 15 inches between the walls, tightly packed with good insulating material, is none too much. An added safeguard would

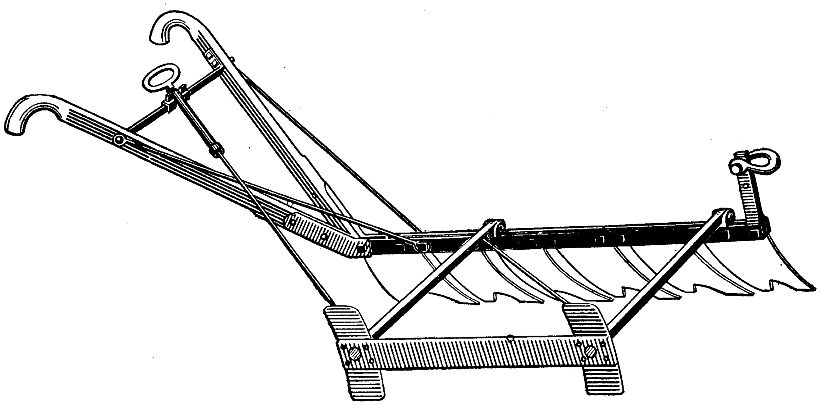

FIG. 3.—An ice plow with a guide gauge.

be to double both the outside and inside walls. The type of wall construction suggested in figure 2 would be suitable for a house intended for the storage of ice of this character.

Harvesting ice from 6 to 15 or more inches in thickness permits the use of tools and implements that find no place in harvesting thin ice. The field may be laid off so as to cut the cakes to standard dimensions of 22 by 22 inches or 22 by 32 inches. Oblong cakes have some advantages over square ones, as they can be lapped so as to break joints as they are stored, thus reducing the possibility of the formation of air passages in the ice heap.

In order to obtain cakes square or rectangular in form a square made from light strips of boards with straight edges may be used. A square with sides 12 to 16 feet long will serve the purpose nicely. Draw a line across the ice field parallel with each side of the square and with a hand marker or with a saw accurately follow this line. By the use of a plow with a gauge attached, such as is shown in figure 3,

the field can be cut into parallel bands or ribbons. If the harvest is an extensive one and the water is of considerable depth, after the field is plowed at right angles to the first plowing the ice may be barred off in large masses or strips and floated to the shore or loading place, where it can easily be broken by an ice spud or bar into cakes of the dimensions outlined by the plow. The use of a plow is not confined to large fields or to ice that will bear the weight of a horse. In fact, ice fields on bodies of water too shallow to permit the use of a saw can be harvested by means of the plow by attaching to it a light wire cable or rope and operating it from the bank by horse power.

FIG. 4.—An ice house equipped with a mechanical hoist for filling.

On fields where ice is stored commercially the cakes are floated in large areas until near the channel, then barred off and carried by hoisting machines to the storage house, as suggested in figure 4. On small fields, where the quantity stored is 50 tons or less, the cakes are cut or barred off, floated to the loading platform, and placed upon it by hand or by horse power. The extent to which labor-saving devices may be introduced is measured by the cost of labor, the extent of the harvest, or the dispatch desired.

FLOE ICE.

Under certain conditions the only practicable way of obtaining a supply of natural ice is to catch it as it is going out in the spring. When the snow melts and the spring rains come on the ice at the headwaters of streams breaks up and is carried down in large masses,

which can be caught at considerable distances from the localities where it was formed. In this way ice can be obtained at small cost. In the early days many plantations along the Potomac harvested an annual supply of ice of this character and stored it for the most part in pits similar to that shown in figure 5. Those fortunate enough to live conveniently near large streams may often obtain their ice supply in this way.

ICE MANUFACTURED IN METAL CANS.

In some localities none of the sources of natural ice will be available. Under such conditions ice may be manufactured by using cans made of heavy galvanized iron and provided with a heavy band-iron or wire reenforcement around the top. Any tinsmith can make such cans. The cans should be of the dimensions of a standard cake of ice; that is, 22 inches square at the top, the bottom being somewhat smaller, so as to make the sides of the can slightly flaring. As soon as settled cold weather comes arrange the cans on a level plat of ground or on a level platform near the well or other water supply. Fill the cans with clear, fresh water, and when a sufficient thickness of ice has formed to permit them to be turned over, even if the shell of ice is not more than $1\frac{1}{2}$ or 2 inches thick, pour a quart or two of boiling water over each upturned can to loosen it from the shell of ice. This will give a hollow shell of ice about 2 inches thick on the bottom, which was formerly the surface of the water in the can, $1\frac{1}{2}$ inches thick on the sides, and with only a thin shell on the top, which was at the bottom of the can. Break the thin shell of ice over the top and remove all but about 2 inches of the water in the cavity. Place the shell of ice in an exposed but well-shaded situation, and as rapidly as the water in the shell freezes add a few quarts at a time until the entire cavity is filled and a solid block of ice is produced. In this way, with 15 to 25 cans the necessary supply for a farm can be secured at small cost in a few days, the time depending, of course, upon the weather conditions and the number

FIG. 5.—Superstructure of a pit for storing ice.

of cans in operation. If the cans are carefully handled they should last several years. The ice obtained in this way will be pure—free from vegetable growth, which sometimes damages pond and river ice. Because of its superior quality such ice will justify the construction of a building which will permit its being stored without the use of sawdust or shavings. A building constructed after the plan suggested in figure 2 will meet the requirements.

COMBINATION OF NATURAL AND ARTIFICIAL MEANS OF OBTAINING ICE.

The home ice supply is sometimes obtained by using a combination of natural and artificial means. Where an elevated water tank is at one's command, a line of pipe can be carried to perforated pipes placed on the ceiling of the ice house and during freezing weather the pressure from the tank can be used to carry water through the perforated pipes to be sprayed into the storage chamber as long as freezing continues. By careful use of this plan on cold nights and during freezing days a supply of ice can be built up in place. The protection of such a supply is the same as that of ice cut and stored in the usual manner.

TYPES OF ICE HOUSES AND THEIR ADVANTAGES.

Since ice at best is a highly perishable product, requiring special equipment for its preservation, such natural advantages as are offered by shade and exposure should be taken advantage of in locating an ice house. A shady situation with a northern exposure has a decided advantage as a location for such a building.

In general design ice houses are of three types: (1) Those built entirely above ground; (2) those built partly above and partly under ground; and (3) those of the cellar type, built entirely below ground. The aboveground structure is by far the most common of these types.

The advantages and disadvantages of these three types may be briefly stated as follows. Aboveground houses can, as a rule, be more economically constructed than either of the other designs. Excavations are expensive to make and difficult to insulate and drain properly. Insulation and drainage are two of the most important factors in the preservation of ice. It is true that the temperature of the earth varies less than that of the air, but the fact that the temperature of the earth at 6 or 8 feet below the surface remains at or about 55° F. the year around makes it quite as important to protect the stored ice against the earth heat as against the heated air. It is more difficult to remove ice as needed during the season from pits than from structures above ground. Slight advantages are apparent at harvest time in favor of the cellar or the half-sunken types of house, and under some circumstances they will be preferred to the other type.

CONSTRUCTION OF ICE HOUSES.

As has been explained, the length of time ice may be kept depends upon the character of insulation provided. This will naturally vary with the location of the ice house and the method of construction. Another important factor will be the cost of construction.

The simplest type of ice preservation consists in stacking the cakes in a compact mass on a well-drained site, as well protected as possible by natural or artificial barriers from sun and wind, and covering the mass with sawdust, shavings, fodder, marsh hay, or any other good insulating material. Such a crude method is not to be recommended except as a temporary makeshift for ice which is to be used early in the season.

INEXPENSIVE ICE HOUSES.

An inexpensive ice house which will give good satisfaction in localities on or north of the isotherm of New York City can be constructed as follows: As a site for the structure choose a well-sheltered location convenient to the place where the bulk of the ice will be used during the season. If the area is not well drained naturally, grade the surface so that no surface water can ever flow into or through the building and so that the water from the melting of the ice will be quickly disposed of. In some instances it may be necessary to provide tile drains laid 15 or 18 inches below the surface to care for this water.

Having properly provided against water, both from without and from within the ice house, set a line of squared or flattened poles 4 feet apart, so as to form a square of the dimensions desired. The height of the poles should be the same as the length of the side of the square, if the greatest economy of space and the best keeping conditions for the ice are desired, i. e., a building 14 feet square should be 14 feet high. A house of this size will provide storage for a cube of ice 11 by 11 by 11 feet, which, without allowance for voids, is equivalent to about 38 tons. (A cubic foot of ice weighs approximately 58 pounds, and 1 ton of ice occupies nearly 35 cubic feet.) To complete the ice house, cut the posts to a uniform height and nail a double 2 by 4 inch or 2 by 6 inch plate on top of them. The sides may be inclosed by boarding both inside and outside with rough lumber. To give a neat outside appearance the outside boards may be planed and ship-lapped, or ship-lap siding may be placed over the rough sheathing. The space between the two board walls may or may not be packed with shavings or sawdust. If packed, the packing material should be perfectly dry. The roof may be either a simple even-span one-third pitch roof, with the gables boarded up, or a hip roof.

In order that the house may be filled without unnecessary labor a continuous door should be provided in the middle of one end. The door should be made in two or three sections, and as the house is filled loose planks of proper length should be at hand to place across the opening of the door to hold the packing material in place as the heap of ice grows in height.

The ice must be placed on a bed of sawdust, shavings, or other packing material at least 15 inches deep, and the rick of ice should not approach the side walls closer than 15 or 18 inches, the intervening space being filled with packing material and thoroughly rammed.

MASONRY ICE HOUSES.

Instead of the cheap, temporary construction just described, ice houses of a permanent nature can be built from brick, stone, or concrete. In these, as in frame-constructed houses, the mass of ice should approach as closely as possible a cube in form. If the masonry house is to be used in the same manner as the temporary house no inside lining will be necessary. The packing used about the mass of ice may be allowed to come in direct contact with the wall. A 13-inch brick wall or a 12-inch concrete wall will provide the necessary strength. The masonry walls are not as good nonconductors as timber walls. It will therefore be necessary for the protection of the ice to rely on the packing material rather than on the wall itself. If the house is to be used for storing ice without the use of sawdust or shavings the construction indicated in figure 2 must be followed. The lining must be as complete on the floor and ceiling as on the side walls in order to provide safe insulation.

Masonry houses may be constructed entirely above ground or partly below the surface, as convenience or necessity may dictate.

RELATION OF THE ICE SUPPLY TO FRUIT STORAGE.

In order that fruits may be held for long periods in storage it is necessary that a uniform low temperature be maintained in the storeroom. With many products a uniform temperature is of more importance than a low temperature. With apples, which is the crop usually held in storage, it is desirable that the fruit reach an advanced state of maturity upon the tree, but that the ripening process be checked immediately when the fruit is placed in storage. This sudden check can not be effected in ordinary storage at picking time. It is therefore necessary that the storage house be provided with means for reducing the temperature to the required point and holding it there until natural conditions permit the introduction of cold air from the outside.

Several systems have been used for accomplishing this result. The simplest is to build the ice house as a two-story structure and to store

the ice above and the fruit below. The ice may be stored at harvest time in an ice house or in an ice chamber arranged over the room in

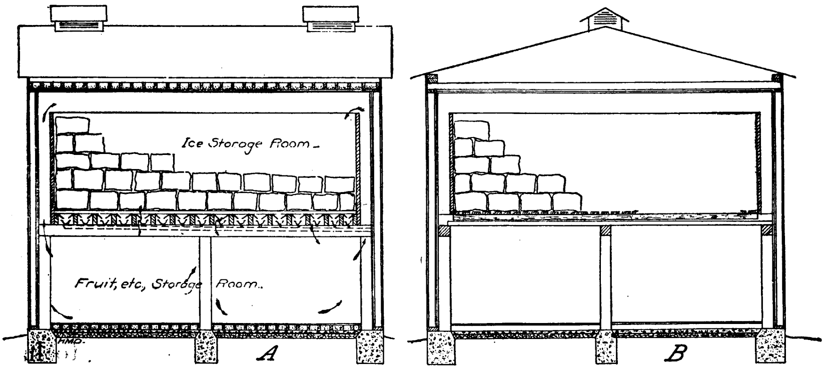

FIG. 6.—Diagrams showing cross sections of a building planned for storing ice above and fruit below: *A*, Longitudinal section; *B*, transverse section.

which the fruit is to be held, or the place may be simply a temporary storeroom to which the ice is transferred at the time the fruit is stored. Both these plans have been followed, but the one to be used in any particular instance will depend upon the cost of handling the ice and the certainty of the fruit harvest.

The general principles involved in the construction of such a house hold for both plans. Where the structure is for combined ice and fruit storage the ice chamber will of necessity be much larger than when ice is used merely to lower the temperature of the house at harvest time. The details of construction shown in figure 6

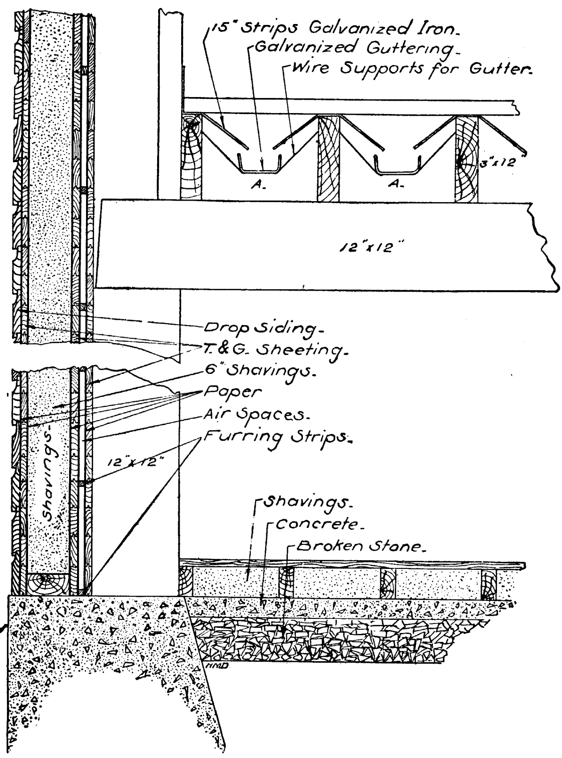

FIG. 7.—Diagrams showing the wall construction and slat floor used in the building shown in figure 6.

may be so modified as to adapt the building for either use. If the object is especially that of fruit storage, the ice chamber may be so reduced as to serve merely as a bunker in which to place several tons of ice at a time, to be replaced as needed. The detail of figure 7 shows a slat floor built of 2 by 4 inch Georgia pine supported on 2 by 12 inch or 3 by 12 inch joists, as needs may require. The joists are protected by a cap of galvanized metal 15 inches wide tacked to and formed over the top of the joists prior to laying the slat floor, so that the drip from each metal cap may be caught by the line of gutter (fig. 7, *A*) which is suspended between the joists. This is one of the simplest types of floor construction possible for this style of structure.

COMBINED ICE HOUSE AND DAIRY.

Even where for convenience and economy it is desirable to have the dairy under the same roof as the ice house, it is not satisfactory to attempt to combine the ice storage with a cold store. When it is necessary to use ice for chilling milk or other dairy products it is

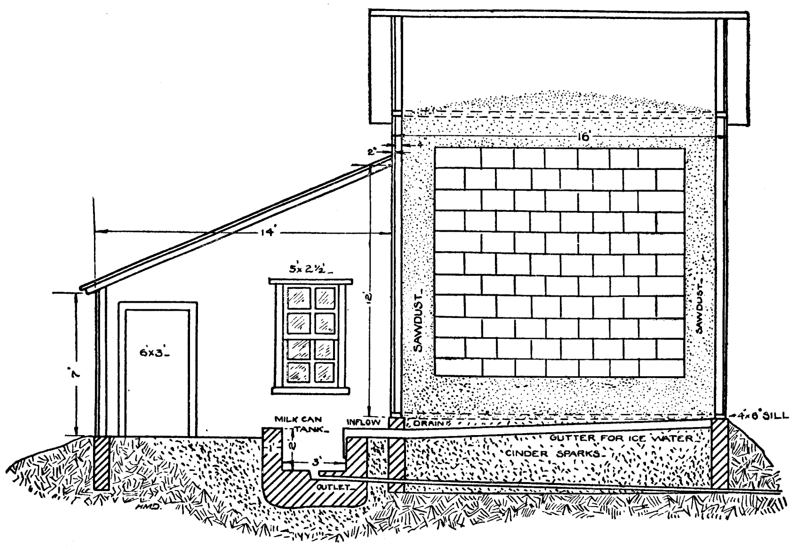

FIG. 8.—Longitudinal section of a combined ice house and dairy.

better to remove the ice from the ice house or compartment and place it in a specially constructed ice box or refrigerator rather than to attempt to maintain a cold room by storing the ice about and in contact with it. The chief argument against the combined arrangement is that it prevents the storage of ice in a solid mass. As a result the waste is much greater. Again, the requirements of the storage room and the refrigerator vary from time to time. Advantage can be taken of these fluctuation to husband the ice supply when

the two are separate. There are decided advantages in having the ice supply convenient to the dairy house or refrigerator, but it is poor economy to build the refrigerator or cold store inside the ice storage. The arrangement suggested in figures 8 and 9 is to be preferred.[1]

COMBINED ICE HOUSE AND REFRIGERATION PLANT FOR THE STORAGE OF FARM PRODUCTS.

Where an abundant supply of natural ice can be harvested annually it will be a simple matter to maintain high-class refrigeration by installing a brine circulating system. The principle on which this patented system works is the same as mechanical refrigeration, except that the cold is secured through a freezing mixture of ice and salt in a tank in which the primary coils are located, as shown at *B* in figure 10. As the brine in these coils becomes chilled it passes out through the bottom of the coils and slowly flows through the coils marked *C*, which are located in the cooling room. The heat of this room is absorbed by these chilled pipes and as the brine warms up it passes out and up into the primary coils, and in this way a continuous circulation is maintained between the two pipe systems.

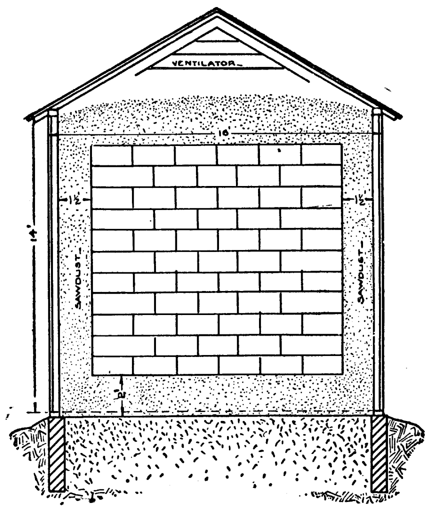

FIG. 9.—Transverse section of a combined ice house and dairy.

For convenience the ice house can be made a part of the structure, so that the ice can be elevated above the storage chamber and directly into the crusher, which can be located in the attic above the primary coils indicated at *B*. As the drawing shows, the space above the cooling room might be utilized as a farm shop or for a cooperage if one were to be installed in connection with an apple orchard. It would not be advisable to attempt to install this system without having an experienced engineer calculate the piping necessary for any given storage room as well as the cooling tank. The question of insulation is also a very important one and should be carefully specified.

[1] For more detailed information concerning the storage of butter, see Bulletin 84, and for the storage of cheese, see Bulletin 83, both of the Bureau of Animal Industry, United States Department of Agriculture.

This construction is adapted to small or to very extensive plants. The Department of Agriculture uses this system in a plant which has been installed at the Arlington Experimental Farm. The cooling room in this case is 28 by 30 feet with 8-foot ceilings. Sufficient space is thereby provided to store 800 barrels of apples.[1]

THE CONSTRUCTION OF A REFRIGERATOR.

The construction of a farm refrigerator large enough to meet the requirements of a well-equipped farm for the storage of eggs, butter, and fresh meat and for chilling or precooling fruits in small quantities is shown in figure 11. This refrigerator can be constructed in a cellar, in the lean-to of an ice house, or in any other farm building where convenient and suitable protection can be provided. If none

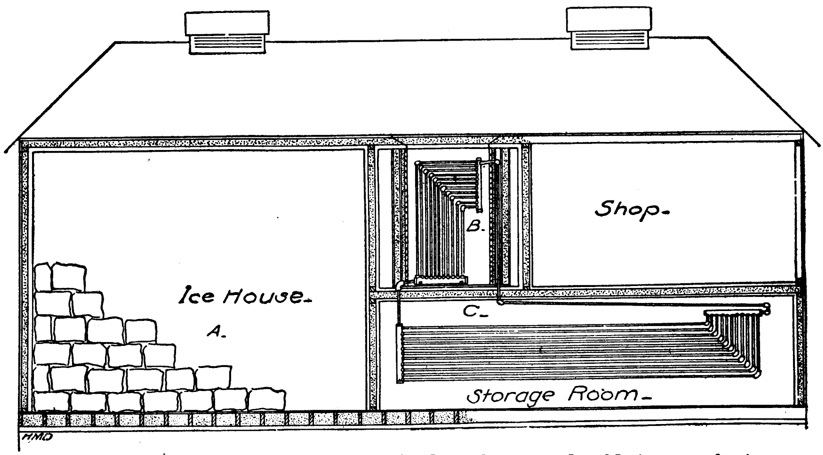

FIG. 10.—Diagram showing a combined ice house and cold-storage plant.

of these alternatives is possible, the refrigerator may be constructed as an independent building. If built as a separate structure, the same care in the choice of a site should be exercised as in choosing the location of an ice house. The construction is shown in detail in figure 11. The essential feature is a well-insulated room containing an ice rack, drip pan, and drain. This refrigerator is 8 by 10 feet and has a floor space 6 by 8 feet available for the storage of produce.

Such an arrangement will require about 100 tons of ice during the year, but it can be used to hold eggs and butter over the season of abundant production. A supply of fresh meat can be kept by such means in localities where distributing wagons are not run, and even where a local supply is available the producer can arrange to supply his table at wholesale rather than retail prices by killing his own

[1] For further information on the storing of apples, see Bulletin 48, Bureau of Plant Industry, United States Department of Agriculture.

sheep, pigs, or veal. Instances are known where an equipment of this sort has paid for itself in a single season through the advance secured by holding the egg output for only 60 days. Dealers purchase and store eggs while they are most abundant and cheapest and dispose of them during the season of less abundant production at an

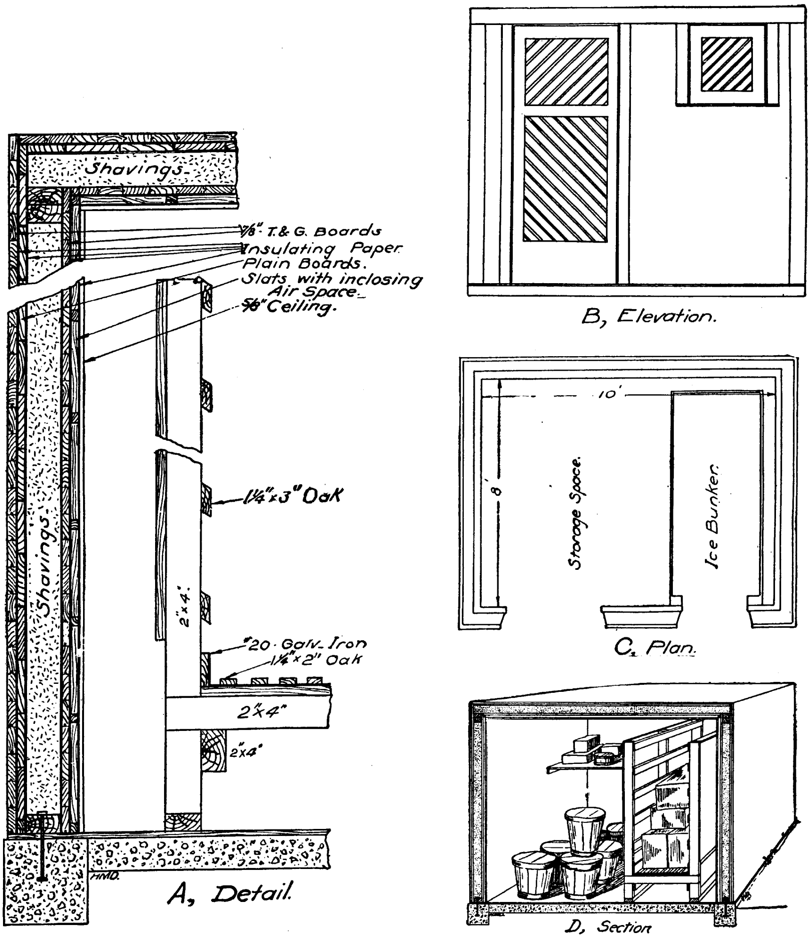

FIG. 11.—Diagrams showing cross section and details of construction of a farm refrigerator: *A*, Detail of wall construction and ice bunker; *B*, front elevation; *C*, floor plan; *D*, sectional view.

advanced price. A well-constructed and well-handled refrigerator of this kind on the farm will enable the producer to keep this profit at home.

THE CONSTRUCTION OF AN ICE CHEST.

Where a less expensive cooler is desired an ice chest will be found to serve a useful purpose. Such a chest can be made from two boxes,

one 12 inches longer and wider than the other and 6 inches deeper. If the inner box is 2 feet wide, 2 feet deep, and 3 feet long, the outer box should be 3 feet wide, 4 feet long, and 30 inches deep. The inner box, which should be made of matched white pine or cypress, should be lined with zinc and provided with a drip pipe in the bottom near one end and a metal grating 12 inches from that end, so as to make a cage in which to store a block of ice. A layer of 6 inches of cork dust or dry white-pine shavings should be placed in the bottom of the larger box after it has been lined with waterproof building paper. Place the smaller box on the layer of insulation, making provision for the drain, and then pack the same insulating material tightly in the space between the outer and the inner box. Fit a board over the packing between the boxes so as to cover the edges of both. Then hinge a thick well-insulated cover to the outer box, which should fit tightly and be large enough to cover the entire top of the chest. The joints can be made tight by weather strips and felt. The cover should be provided with a counter weight and a good ice-chest hasp to hold it in place.

CONCLUSION.

An ample supply of ice on the farm is of great economic importance. The work of harvesting and storing is done at a season when it will cost very little, as help and teams are usually less remuneratively employed during the winter than during the summer months. The cost of constructing ice houses and refrigerators is small in comparison with the economic returns and the comfort which they afford. Ice is of greater economic importance in the country than in the city, yet few who have the opportunity avail themselves of this luxury.

O